REMARKS ON AMPUTATION:

AN ESSAY,

SUBMITTED TO THE

FACULTY OF PHYSICIANS AND SURGEONS OF GLASGOW,

WHEN CANDIDATE FOR ADMISSION INTO THAT BODY,

BY

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TO

DR. ROBERT HUNTER,

MEMBER OF THE FACULTY OF PHYSICIANS AND SURGEONS, GLASGOW,
PROFESSOR OF ANATOMY, WESTMINSTER HOSPITAL, MEDICAL SCHOOL, LONDON,
ETC., ETC.,

My Dear Sir,

You are aware of the regulation of the Faculty of Physicians and Surgeons in Glasgow, which requires every Candidate for admission into their body, to publish an Essay on a Medical Subject.

I am perfectly aware that the task, to which I am thus subjected, is not performed in such a manner as to merit your approbation; but I cannot allow the opportunity to pass without expressing my gratitude for your uniform kindness as a teacher, and for many acts of friendship.

With every wish for your increasing prosperity and happiness,

I remain,

My Dear Sir,

Your very grateful Pupil and Friend,

A. KING.

33, North Hanover Street,
Glasgow, 28*th July*, 1842.

To
Jno Bacon Esq Surgeon
with the Author's regards.

REMARKS ON AMPUTATION.

In the following Probationary Essay, I intend to confine my remarks to points of interest connected with Amputation, rather than to construct, by compilation, a formal paper on the various methods of performing the respective operations which have been recommended by Authors. This must be my excuse for the desultory manner in which the subject is discussed.

Amputation is generally considered an operation very simple and easy of execution, and so far as the mere severing of parts is concerned, it is not attended with great difficulty; but when its importance to the patient, the amount of mental and physical suffering which attends it, and the fatal consequences which too frequently result from it, are maturely considered, I think few subjects are calculated to interest more deeply the serious attention of Surgeons. In large manufacturing towns, where accidents from machinery, &c. are so common, the operation is almost daily imperatively called for; and even in country districts, where diseased joints, arising from the prevalence of the strumous diathesis and the variableness of our climate, are so frequently met with, it is also often necessary, notwithstanding the flood of light which the labours of Brodie and others have thrown on the Pathology and treatment of the articulations.

The accumulated experience which the long continued wars, in various parts of the globe, necessarily produced, during the latter part of the last and beginning of the present century, by multiplying the occasions for amputating, and by calling into the field a more numerous class of observers, appeared to set at rest many disputed questions connected with this operation; but it seems not for ever,—as we will see in the sequel that some of the more recent writers challenge the correctness of data which were considered as established at the close of the Peninsular war in 1815. In reviewing shortly a few of these unsettled questions, I have no hope of being able to add to what is already known. A much more extensive field of observation than ever falls to the lot of a country Surgeon is necessary to arrive at correct conclusions; indeed, the great diversity of opinion which prevails among surgical writers, would lead me to doubt if the opportunities which the largest hospitals afford, are sufficiently extensive for this purpose.

The Statistical Tables, furnished from various sources within the last half century, especially within these few years, prove this operation to be attended with a much greater mortality than some others, which are considered of greater difficulty and importance; indeed, with the exception of that for strangulated Hernia, it is the most fatal of the ordinary surgical operations. The whole of this mortality cannot with justice be charged against the operation simply, as many of the patients die of injuries, with which the one demanding it has been complicated, or of diseases, to rescue them from which the operation was resorted to; but I think it would not be difficult to prove that in hospital practice, the mortality after amputation, is increased from a variety of circumstances which admit of being successfully combated by proper attention to some of the best established principles of our Art. During my attendance as a student in the Glasgow Royal Infirmary, the mortality was very great after operations, and other surgical cases, and I was led to consider an amputation as a very formidable undertaking—one with which a young Surgeon, to whose want of the requisite skill, unsuccessful cases are generally attributed, should be very chary in interfering; but on commencing practice in a healthy rural district, I was agreeably disappointed in finding the practice of surgery a much less onerous and painful duty than I had been led to anticipate. The erysipelas,

phlebitis, subfascial inflammations, secondary deposits, &c., which I had been accustomed to see follow amputations, small incised wounds, or even the operation for venesection, were never met with, and the kindly manner in which incised wounds healed, induced me to undertake amputations, which terminated most favourably. Since my removal to this city in August last, I have been a pretty constant visitor in the hospital, and have witnessed a mortality in surgical cases, which I consider truly dreadful and alarming, and which calls loudly for the enquiry and investigation of both the Directors and Medical Officers. My attention having been thus much directed to the operation of Amputation and its consequences, I have selected it as the subject of this Essay.

To decide when the removal of a limb becomes necessary, is perhaps one of the most difficult questions within the range of Surgery. That no fixed and determinate data have been as yet ascertained to guide us, is sufficiently proved by the diversity of opinion so often expressed in the consulting room by Surgeons of acknowledged ability and experience. Extreme cases present little difficulty; but the various intermediate degrees of injury and diseased condition can only be mastered by almost unlimited observation. Indeed, few Surgeons will be ashamed to confess that the result has occasionally proved their opinion to be erroneous, and their practice inexpedient, if not positively injurious. On the proper solution of this question depend not only the limb, but likewise the life and happiness of a fellow-being. To remove a limb, which by judicious treatment might be saved, and rendered available for all useful purposes, is highly criminal, and derogatory to the profession; on the other hand, fruitlessly to attempt saving a limb, which, after protracted suffering and misery, causes the death of the patient, is not much less worthy of censure. If the patient cannot be saved, except by surgical means, it is certainly highly proper to afford him the chances of an operation, so that, as Dionis remarks, instead of the positive certainty of dying with four members, he may have the chance of living with three. In all doubtful cases, every conscientious practitioner will state to the sufferer the real circumstances of the case, his hopes and fears, and thus allow him to choose for himself,—to be the arbiter of his own fate.

While I highly deprecate rash interference, I am of opinion

that many lives are sacrificed by foolish attempts to save limbs, which, even could the object be accomplished, would be useless encumbrances. For diseased joints, the operation is now seldom proposed, till the constitution has deeply sympathized with the local affection, or some new and more urgent symptom has supervened so as to put the patient's life in immediate jeopardy; and the result too frequently is, that the pain, &c. are borne for no good purpose, the work of destruction, in the form of secondary inflammations, having already commenced, and the operation may hasten dissolution, but there is little reasonable hope of its saving life. Much useful time, in particular, is spent in attempting to effect anchylosis of the knee joint; in hospital practice disease manifests itself in some other organ before the end is accomplished, and even in the small proportion of successful cases the limb is shrivelled, and bent nearly at right angles, and the patient requires the constant use of a crutch; consequently, unless his employment is sedentary, he has the use of only one hand. A patient is capable of being a much more useful member of society, with a proper artificial limb, than with his own crooked, deformed, and much worse than useless member.

Amputation being judged necessary, at what period after an injury is the operation to be performed? This question has at various periods, in the history of surgery, divided the profession into two parties; the one maintaining that the operation should be performed immediately, or within twenty-four hours after the accident, the other party asserting that it should be delayed till the shock and consequent reaction have worn off, and the suppurative process be fairly established. It has also been performed at an intermediate period, but it is not recommended at this stage by any experienced Surgeon. This three-fold division into primary, secondary, and intermediate, is necessarily very arbitrary; the period at which the symptoms of inflammation—the pain, heat, redness, and tumefaction show themselves, depends entirely on the nature and seat of the injury, the age, habits, and constitutional idiosyncracy of the patient, it may commence in eight or ten hours, and in some instances after thirty; but if an operation be performed after this has commenced, it is no longer primary, whatever may have been the delay.

For delayed amputation, we have the names of Faure, Le Conte, and John Hunter, and in the opposite ranks we find Guthrie, Hen-

nen, Thomson, Hutchison, Hammick, and Barons Larry and Percy. Perhaps both parties in their anxiety for the promulgation of their respective opinions, have gone beyond the

" Certi denique fines,
Quos citra vel ultra nequeat consistere rectum."

By a reference to the Tables in the Appendix, it will be seen that the majority of English and French surgeons were entitled, as far as the evidence of numbers went, to conclude the question as settled in preference of the primary operation; however, some of the more recent writers advocate almost opposite doctrines, so that the question may be said to be, to a certain extent, still an open one. Mr Guthrie, in his excellent work on gun-shot wounds, says, " Let enquiries be made of the friends of those who died after amputation, at what period it was performed? and one instance will hardly be found in ten, of an unfortunate termination after operations performed on the field of battle."—Page 222.

The following gives Mr Guthrie's opinion of the comparative merits of immediate and delayed amputation:—

" Suppose sixteen men have each a knee shattered by a cannon or grape shot, without destroying either the circulation or the connection of the limb, but in such a manner as to render amputation necessary; of these, eight shall have been amputated on the field of battle, and eight delayed for amputation when the first inflammation has subsided, and suppuration is duly established. Of the first eight amputated on the spot, or within twenty-four hours after the injury, I assert, from my general experience, that on the average of three trials six would recover; and from the same source I affirm, that of the eight delayed cases, not one half would live to the proper period of performing the operation, and of the four remaining, not more than two would ultimately recover after amputation."—*Page* 224.

Immediately after a serious injury the nervous system is peculiarly torpid and inactive, and the pain of an operation is consequently less felt. This is very distinctly marked in many cases, and probably always exists to some extent. If the nature of the injury is such as to preclude the possibility of saving the limb, the additional shock on the nervous system, I think, will be lessened, by its nearer approximation to, and by its being made in some measure to blend with the shock of the injury. The primary shock may be too great to withstand any additional injury, and under such circumstances Mr Guthrie recommends delay—" That the sufferer may have time to recover from the

shock of the injury, and approach as near as possible to a state of health; and the farther he is from this *state of health* the greater the chance of a fatal termination." During the delay external and internal stimuli must be judiciously used, and the patient carefully watched, so that the most advantageous period may be seized for the operation. In many cases which demand removal of the limb, the nerves and blood-vessels are more or less lacerated and destroyed, and instead of the patient gaining strength by delay, and approaching under such unfavourable circumstances, nearer to a state of health, I fear the vital powers are likely to become more prostrate by the hemorrhage, nervous irritation, or a combination of both. Such cases scarcely admit of being brought under any general rule, and the Surgeon must be guided by the peculiarities of the one before him.

Mr Copland Hutchison, in his practical observations, combats, but I think very unsuccessfully, the doctrines of Mr Guthrie. He denies, *in toto*, the existence of *shock* after an injury, and asserts that " the operation ought not to be deferred one MOMENT;"—he appears to reckon an operation performed six hours after an injury secondary. Mr Hutchison has few proselytes amongst practical Surgeons. Few deny that after a serious injury the countenance is found deadly pale, extremities cold, and the pulse feeble and languid, and that, if these phenomena are very marked, the infliction of an additional injury by the knife will almost to a certainty terminate in dissolution.

It is almost impossible to settle this question by Statistics. Many die, after primary amputation, of injuries of some of the viscera, which have been overlooked when the operation was undertaken; others demand removal of the limb at an intermediate and more unfavourable period; a third portion sink before the period for secondary amputation arrives; and the fourth are too much reduced and exhausted to withstand the shock of the removal at the late period. Except the state of the patients and the circumstances in which they are placed, be thoroughly known, tables cannot give even an approximation to the truth.

The following is given by Mr Alcock, and may be consulted with advantage. The tables in the appendix contain nearly all that is published on the results of amputation:—

	PRIMARY.			SECONDARY.		
Mr Guthrie's Series at Thoulouse :—	No.	Died.	Mortality.	No.	Died.	Mortality.
Upper Extremity,.....	7	1	7.	16	4	1 in 4
Lower Ditto,.....	41	9	4.5	37	18	2.
Mr Alcock's Series in Spain and Portugal —						
Upper Extremity,.....	12	1	12.	12	2	6.
Lower Ditto,.....	21	4	5.2	21	10	2.1
Messrs Hayward & Norris's Amputatiou for Iujuries received into Civil Hospitals :—						
Upper Extremity,.....	17	3	5.6	11	1	11.
Lower Ditto,.....	26	8	3.2	25	11	2.2
Messrs Hayward & Norris' Amputations for Chronic Disease :—						
Upper Extremity,.....	10					
Lower Ditto,.....	48	8	6.			
	58	8	7.2			

With the opinion of Mr Rutherford Alcock, one of the most recent writers on amputation, I will conclude this part of my subject:—

"I am not afraid of beiug put down as a theoretical writer; I have seen several hundred amputations, performed a large uumber myself, and watched, with the greatest care, the whole progress of at least some five hundred severe and complicated injuries of the extremities in the hospitals under my own personal direction, aud, of course, each and every amputation to which they gave rise. I speak without hesitation, therefore, though, I trust, with no overweening confidence or presumption, of what I have seen and studied in no very limited field for observation; and I am bound to add my conviction of the truth of what John Hunter advanced, and Faure and Le Conte before him, (however out of vogue, and talked down, and almost out of sight and memory such opinions may be,) viz., that the system is not in the best state to bear the shock of an operation within twenty-four hours after the receipt of a violent injury, such as a gun-shot fracture; and that patients, in two cases out of three, are in a more favourable state at a succeeding period, if no organic disease shall have been developed, or the patient be not utterly exhausted."—*Lancet*, 1840—1, vol. ii. p. 291.

From the tenor of this passage we would expect some new recommendation, but after perusing very carefully Mr Alcock's somewhat complicated course of lectures, I have been unable to discover any doctrine differing in any material point from what is advanced in Mr Guthrie's work already referred to; indeed, he shortly afterwards expresses his unwillingness that he should be considered an advocate for delayed amputation, even when the operation is decided to be inevitable at the first moment.

The operation of amputation is sometimes rendered unnecessarily complicated and tedious by the use of too long a knife for the first incisions, which requires to be exchanged for one of smaller dimensions, to complete the separation of the deep-seated textures surrounding the bone. Except at the upper part of a massive thigh a change of knives is never necessary. An ordinary sized Lisfranc's knife, over which the operator has full command, is better adapted for all the steps of the operation; with it the Surgeon can calculate the size of his flaps, and cut down to the bone with much greater precision, than with one of more ponderous dimensions.

A Surgeon in the country has seldom the advantage of an assistant on whom he can depend for the proper compression of the blood-vessels of a limb, and the Tourniquet is consequently always used. I have not been able to discover the validity of any of the objections urged by modern improvers against the use of this instrument.* If it be not applied till the knife be lifted, it cannot occasion, to any injurious extent, the venous turgescence complained of, and the retraction of the soft parts which it causes can be easily prevented by a skilful operator. When enlarged lymphatic glands lie over the course of the blood vessels, the Tourniquet is decidedly preferable to compression with the hand. I have seen an injurious loss of blood occasioned by trusting to compression when this state of parts existed; but in ordinary circumstances, I think there is no use for any apparatus whatever if a proper assistant be at hand. When the patient's residence was several miles distant from professional assistance, I allowed the instrument to remain on the limb, and instructed himself or the attendant how to tighten it, in the event of the occurrence of hemorrhage.

Some Surgeons imagine that almost every thing depends on the kind of operation, and advocate one method to the exclusion of every other. I think the operation is comparatively of less consequence than the after management of the case. Every endeavour, unquestionably should be made, to diminish the intensity, and shorten the duration of the pain, inseparable, to a certain extent, from this operation. Patients have undoubtedly perished from its being unnecessarily prolonged, and the amount of suffering has thereby been

* "The Tourniquet is now only used by operators of the old school, or those of the modern, ignorant of anatomy."—*Vide Lizar's Surgery, page* 206.

rendered too overwhelming for the constitutional vigour. The less the degree of shock inflicted on the constitution, the greater the chance of a speedy and successful termination; and in every instance will the reaction be in proportion to the injury to the vital functions, occasioned by its peformance. Rapidity is not always a safe criterion, but if the operation is, in other respects, well performed, the more speedily it is executed the better for the patient; and if one method of operating admits of being more speedily accomplished than another, it should in general be preferred, if there be not unfavourable circumstances connected with it to counterbalance the advantage.

The method of operating by flap, which appears to have originated with Mr Lowdham of Oxford, and is now generally adopted in this part of Scotland, is, after time has been afforded for a fair trial of its merits, very generally admitted to be more easily and rapidly executed than the circular, and consequently less painful to the patient; and usually the reunion is more speedy and certain, the stump is better covered, less conical, and in every respect better suited for all after purposes. It is alleged that the blood-vessels are secured with great difficulty after the flap operation, in consequence of being cut obliquely; but this appears to be a theoretical objection. Until Mr Liston's removal to London, the flap operation was almost exclusively confined to Scotland, and the circular is still generally preferred in England, on the Continent, and the United States of America. I have always adopted the flap operation, because I think the ease and rapidity with which it can be performed, recommend it strongly to young Surgeons; but from what I have seen in the practice of friends, and in hospitals, I do not think that the double flap, the oval, or any of their combinations deserve the exclusive preference which Mr Liston appears to give them. Malgaigne, a very excellent authority, in his *Operative Surgery*, prefers on the whole the circular method; and Dr Lawrie, to whose practical lectures on Surgery I owe much, is also favourable to the circular. Dr Ballingall, in his *Military Surgery*, says:—

"I know of no comparative estimate of the results of amputation performed by the circular incision, and by the double flap, which will enable to decide their respective merits by the test of experience."—*Page* 368.

In the truth of this observation I fully concur. The tables given by

Mr Alcock, in his lectures in the *Lancet* (1840-41), page 647, are very unsatisfactory, and the numbers are too small to settle the various questions involved.

In some regions, the circular is, I think, decidedly preferable to the flap operation, especially at the middle of the arm and upper part of the leg. The muscles at the latter region are massive and powerful; and if the knife be introduced behind the bones, and the flap made in the ordinary way, by cutting from within outwards, too much muscular substance is left, which afterwards projects beyond the skin, and renders the cicatrization of the stump a very tedious process. When the flap operation is preferred at this part, care should be taken to make the incisions at a distance from the bone, varying according to the size of the limb to be removed, so that only a sufficient covering may be left. A plan occasionally followed by Mr Liston answers very well at this part;—an anterior and posterior flap of skin only being reflected back from the textures underneath, and the knife carried down to the bone by a circular sweep.

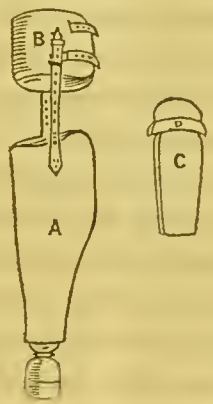
There is much diversity of opinion among Surgeons of eminence regarding the propriety of amputating immediately below the tuberosity of the tibia, for diseases of the foot and lower part of the leg. The question is of very considerable practical importance. Every day's experience proves that the less the amount of substance removed, the less the risk to the patient, and hence the danger of amputation is increased the nearer we approach the trunk of the body. The fingers are removed at less risk than the carpus—the carpus than the fore-arm—the fore-arm than the arm. A reference to any statistical table will prove these statements; and such being the case, the low operation is to be preferred, if there be not some serious objections to counterbalance the advantages of safety. Mr Liston, in his *Practical Surgery*, says,

"If the patient have not any laborious employment to follow, wishes to conceal the deficiency, and can afford to purchase an artificial foot, then the stump should be left sufficiently long for its attachment, so that the motions of the knee may be preserved, and the gait rendered less awkward. If, again, the patient is otherwise situated, the shorter the stump the better and more serviceable it will be. There can be no greater mistake than to leave a working man a long stump below the knee. It is continually in the way, and I have very often, indeed, been induced to comply with the request of patients to have their stumps shortened, and made of more convenient length."—*Page* 317.

More recently similar opinions have been advanced by Mr Potter. He says, "to patients who are obliged to wear the common wooden

pin, and labour for their living, it (a long stump) is found a very useless, and frequently much worse than useless appendage."*

In Glasgow, instead of "the common wooden pin," on which the bent knee is made to rest, an apparatus resembling that used for the thigh can be procured at less cost. It consists of a hollow wooden box, to which a short wooden pin is attached, and is made to press on a pad fixed round the leg below the knee. When such an apparatus is used, the patient has the free and unrestrained use of the knee joint, and walks with as great freedom and ease as if he had only an anchylosed ankle joint; whereas with the pin, he requires to drag the leg behind him, on account of the action of the muscles being interfered with, by the bent state of the joint. This apparatus is equally well calculated for all other purposes as well as walking; and as it does not seem to be sufficiently well known, I subjoin a drawing of it. I have seen many cases illustrative of the advantages of the low operation, both in respect to safety and after usefulness.



A—The hollow wooden box which receives the stump.
B—Belt which is fixed above the knee, and attached to the leg by two straps.
C—The leather bandage which laces round the stump.
D—The circle of strong leather against which the upper part of the box presses.†

The following struck me very forcibly at the time of its occurrence:—In 1840, I removed, with the assistance of my friend, Dr Hunter, the limb of a person advanced in life, for disease of tarsal bones of nearly forty years' standing. His constitution had suffered severely from long-continued pain, confinement, and hectic fever;—and the low operation was preferred on account of its greater safety. He remained

* Med. Chirur. Trans., Vol. xxiv., p. 165.
† To be had of Messrs. Marrison and Edwards, 69, Buchanan Street, Glasgow.

in a reduced and critical situation for several days succeeding the operation, but ultimately made a very good recovery. From the constitutional depression witnessed in this instance, I am satisfied the termination would have been fatal, had the additional shock and risk of the high operation been incurred, and others who saw the case concurred in this opinion. The individual now walks with great ease, and with a very trifling halt, on an apparatus made on the principle of the one referred to. His seat on horseback is as firm as before the operation, and he experiences little inconvenience from the want of the member.

I prefer the anterior and posterior to the lateral flaps, when the thigh is the part to be removed. When the flaps are laterally formed the bone is apt to be raised by the action of the muscles, or in the act of dressing the stump, and left uncovered at the upper angle of the wound; and the pressure of the lower edge upon the pillow, separates the incised surfaces, prevents adhesion by first intention, and leaves a large suppurating cavity. When the line of incision is transverse, the surfaces are pressed together, and maintained in apposition around the bone by the weight of the parts themselves, and a most favourable opportunity is thus afforded for immediate union. By keeping one angle somewhat lower than the other, the pus is allowed as free an exit as when the flaps are formed laterally.

The dressing of the stump, and the local and general after treatment, are of great consequence after amputation. The dressing is frequently performed in a manner ill calculated to promote the object the British Surgeon has chiefly in view, viz., the adhesion of the incised surfaces by first intention. I have frequently seen applied, strap after strap, of adhesive plaster, numerous pieces of lint, and over all, endless rolls of bandages, as if the intention was to seal hermetically the cut surfaces. Than such management nothing can be more detrimental. The blood which oozes out after the dressing, and the secretions which are afterwards formed, cannot escape,—are pent up between the cut surfaces—become putrid, and burrow upwards amongst the muscles, cellular substance, &c. and dissect extensively around the bone. When the first dressings come to be removed at the expiration of a given time, a large bag-like stump, with extensive suppurating, or it may be, sloughing surfaces, presents itself, which the surgeon finds a very difficult matter to bring to a healthy con-

dition, and frequently before that is accomplished, phlebitis manifests its presence, and the patient's doom may be said to be sealed.

The simpler and lighter the dressings the more favourable the result of the case. I have been in the habit of bringing the incised surfaces together, and keeping them in that state by two or three stitches, assisted by a narrow strap of plaster between each. Care is taken that sufficient openings are left for the escape of pus, &c. between each stitch and plaster. Over the line of incision is applied a piece of lint spread with soft ointment. An equable pressure is kept up over the whole limb by the application of a bandage, commencing from above, and carried downwards by circular folds to nearly the edges of the incision, but avoiding the front of the stump, in case of retarding the escape of matter. The limb is then placed on a pillow, on a level with the body, with one edge of the wound slightly depressed, and covered in such a manner as may best suit the season of the year.

This simple method of dressing the stump appears to have many advantages. The lint can be removed at any time, and the state of the cut surfaces accurately ascertained. If any of the stitches or straps of plaster cause irritation they can be cut across with the scissors; and if too much action be going on in the stump, it may be moderated by proper local applications. If matter be formed in the interior of the stump, its escape may be facilitated through the ligature openings by gently moving and separating these bodies; and the straps of plaster may be removed and replaced at any period after the operation, one by one, as may be found needful, thus rendering a formal first dressing, (sometimes as formidable to the patient as the operation itself) at a given period, altogether unnecessary. The practice of covering up the face of a stump, by plasters, ointments, &c. &c. which even at the present day is so common, and removing the whole at any period between the third and the sixth day, washing the surface, and reapplying a similar quantity of fresh dressings, is, in my opinion, very bad surgery—alike opposed to the dictates of common sense, and the principles of sound physiology. The Surgeon, who keeps the face of a stump covered with heavy complicated bandages and dressings, for several days subsequent to the operation, virtually commits the cure to chance during the most important period. A reaction, which at first might have been moderated, or subdued, by the early application of cold cloths, or by

surrounding the stump with bladders filled with cold water, renewed when neeessary,—thus neglected, too frequently runs on to the suppurative stage, and the stump has afterwards to heal by the slow process of granulation. A stump which is kept at a proper temperature will seldom inflame, or the increased activity of the nervous and capillary systems occasion pain, heat, redness, or swelling; but will be limited to the *adhesive inflammation* of John Hunter, which is merely an action which renders the vessels capable of throwing out the plastic element of union, and very different from *suppurative inflammation.**

Dupuytren was the originator of a method of managing the stump, which has been introduced and keenly advocated in this country by Mr Liston. Instead of bringing the surfaces together immediately after the ligatures are applied, the patient is removed to bed, and the wound covered with lint wetted with cold water. After six or eight hours, when the bloody oozing has ceased, and any coagula removed, which may have been formed, the stump is dressed. It is alleged that this method diminishes the risk of secondary hemorrhage, and is consequently safer for the patient than that usually followed. That hemorrhage does occasionally occur, when the patient, from being in a state of collapse on the table, has become heated in bed, is unquestionably true; but if the most important blood-vessels have been carefully secured, its occurrence is too unfrequent to justify a surgeon in resorting to such a harsh expedient, as I consider dressing *a deux temps* to be. Notwithstanding what has been said to the contrary, I am satisfied from the few cases in which I have seen it tried, that the patient suffers nearly as much from the continued anxiety and alarm, joined with the pain of the dressing at the late period, when the parts have become swelled,—more or less inflamed, and acutely sensitive, as from the operation itself. When secondary hemorrhage does unfortunately occur, the patient will suffer less from the separation of the edges, and the application of a ligature to the bleeding vessel, than from the alternative which Mr Liston has suggested. Every body knows that very slight pressure is often sufficient to arrest hemorrhage from arteries of the third and fourth importance, and the mere pressure of the flaps will close up many vessels from which more or less blood will issue if left covered with

* See the works of Hunter, Thomson, and Cruveilhier.

wet cloths. Weak, debilitated patients frequently fall into a tranquil and refreshing sleep, after the fatigues of an operation; an event so highly desirable cannot happen when the dressing is delayed, as the patient's mind is in a state of perpetual excitement till he is satisfied all is over; he cannot be expected to know all the steps of the operation, and after having borne the pain of an amputation, he must be excused for exhibiting more or less incredulity, when told that the subsequent dressing is attended with no pain. The plan has been fairly tried by many practical men, and has been very generally condemned.

Immediate union of all incised surfaces has been the aim and ambition of British Surgeons ever since the advantages of the practice were pointed out by Mr Alanson, towards the end of last century. On the Continent the "charpie, &c." continued to be used for the purpose of preventing adhesion; and this point constituted one of the characteristic differences between English and French practical Surgery. When the unfavourable results of the French practice, contrasted with the brilliant success of our method, are duly considered, as well as the many disadvantages inseparable from delayed union,—the pain—the troublesome dressings, and the profuse wasting suppurations, it appears surprising that the superiority of immediate union should not have been more readily acknowledged; but it is still more amazing to find many recent writers advocating a retrograde movement, and attempting to prove the superior advantages of secondary adhesions by reference to statistics. Mr Phillips, in a paper on the subject in the *Medical Gazette*, after giving the result of 213 cases, collected from various public and private sources, concludes, "The result, therefore, attendant on the practice of immediate union, is a mortality of 25 per cent.,—upon consecutive union of nearly 21 per cent." I do not think that any conclusive results can be drawn from Mr Phillips' tables, as we know nothing of the circumstances under which the patients were placed, and they are in other respects also unsatisfactory.

A more recent writer in the pages of the *Lancet*, says:—

"When, by the Surgeons' 'cunning' art, the edges of the stump are suddenly glued together by the adhesive process, what is the result? Is the patient suddenly well? On the contrary, the fever is often more violent, obstinate, and fatal, unless, by a somewhat perilous effort of nature, she succeeds in bursting the adhesions of the stump, and establishing a plentiful suppuration; or, failing in this, purulent depots are established in the face of the stump beneath, in the

limb above, extensive disease of bone and periosteum, abscesses along the course of the vessels, and finally phlebitis. These are frequently the results, as they are rewards of a blind adherence to the established doctrine on the invariable expediency and advantage of immediate union, maintained so long against the most striking and conclusive series of facts that could well be devised to force observation and conviction to men's minds."—*Lancet*—1840-41, page 711.

Where the "most striking and conclusive series of facts," referred to by Mr Alcock, are to be found, I know not. I have failed in discovering them in his lectures or tables.

For a better understanding of the question, it may be proper to consider the effects of an amputation. They may be said to be twofold.—I. The *Constitutional*, which are, the shock inflicted on the nervous system, and the reaction, or febrile excitement which follows. In some instances the sedative influence of the shock is so powerful, that the patients die under the hands of the operator, or fall into a state of stupor and collapse, from which they cannot be aroused; while in other cases they bear up against it for several days, but finally die of what may still be termed the constitutional effects of the amputation. It has been already stated, that the more moderate the shock, and the consequent reaction, the greater the chance of a speedy and successful termination of the case, and therefore every Surgeon endeavours to lessen them.

II. The *Local*, which are, the incised wound of the soft parts, and division of bone. Judging from analogous cases, we would be led to conclude that the more rapidly the local injuries are repaired, and the bone, nerves, and blood-vessels surrounded and supported by integument, the sooner would the patient be removed from the danger. So long as the wound is unhealed, the patient is liable to the occurrence of hemorrhage, sloughing or inflammation of the stump, exfoliation of bone, and the whole host of diseased actions supervening on Amputation.

The alleged risk of healing up clean incised surfaces, is beyond my comprehension. Who ever saw evil consequences follow the immediate and permanent union of cut surfaces? Nature, unaided by the Surgeon's "cunning" art, frequently repairs by this process extensive solutions of continuity,—and cut surfaces larger than any ordinary flaps, are frequently thus united almost without the formation of a single drop of pus. It is highly reprehensible to allow the *skin only* to unite or be glued together, whilst the muscles and other textures

are separated, but no argument can be drawn from this practice against union by the first intention, by which is meant adhesion of all the textures. When union by the first intention is accomplished, the blood-vessels, nerves, &c. are for ever concealed from view, and have in their immediate proximity sound healthy substance; but when the flaps are made to unite by granulation, these important structures are for weeks exposed at every dressing, and are perpetually imbedded in pus of a more or less irritating quality. I would beg to ask the advocates of secondary union which of these conditions is most likely to give rise to phlebitis,—a disease so common and fatal after operations, and other surgical cases, in a crowded hospital? Dr Lawrie says,

"Experience confirmed my objections to union by second intention. The cases in which I tried it, certainly few in number, died of phlebitis and secondary inflammations, in their most acute forms."—*Lawrie on Result of Amputations, page* 12.

In hospital practice, the surgeon, however anxious he may be to obtain instant union, seldom succeeds in consequence of the unfavourable circumstances under which his patients are placed, and the mortality, as will be seen by a reference to the Appendix, is very great. In healthy country places immediate union generally follows every case, and the mortality is very small. In eight out of nine cases, which came under my own charge, in five of which extensive suppuration had pre-existed, this desirable result followed, over the greater part of the flaps, and the only case which caused much trouble or anxiety was that which closed slowly by granulation. Mr Alcock himself does not recommend the delay necessary for the accomplishment of secondary union, when the circumstances are unfavourable. He says,

"If the external circumstances are very unfavourable, such, for instance, as crowded hospitals, with sultry weather, bad attendance, necessity for transports, a prevailing epidemic, &c., then, indeed, I should rejoice to see my patients as rapidly as possible removed, by their entire cure, from such deleterious influence."—*Lancet*, 1840-41.

If the wound, even in favourable cases, can give rise to the most remote danger, (and till cicatrization is complete the patient is never free from risk,) why not remove every cause of apprehension by the entire cure?

It is alleged, that the most pernicious results are likely to follow the immediate union of the stump, when extensive suppuration has existed in the limb before its removal. This doctrine appears very

theoretical; its existence in practice is denied by Surgeons of the highest standing, and the cases adduced in its support by Mr Alcock are of the most unsatisfactory description. Mr Guthrie, no doubt, gives it as the result of his experience, that fatal secondary deposits of matter in chest, liver, &c. &c. are more common after secondary amputation, and when suppuration has been profuse previous to the operation, than after primary, and appears to attribute this to the sudden arrest of the discharge; but he grants "the continuance of the discharge would soon have destroyed the patient." It must be borne in mind, that an operation is never performed at this late period, except the symptoms have become more aggravated, or some new cause of alarm presented itself, demanding the removal of the limb. In many of these cases the morbid action has commenced before the knife is resorted to, and would have terminated fatally, although no operation had been performed. For instance, a compound fracture is put up in the ordinary manner, and every thing goes on favourably for a time, when, without any assignable cause, the patient has a rigor followed by profuse perspiration,—the appearance of the limb becomes less favourable, and the discharge more profuse,—a consultation consider amputation advisable,—the patient, a few days after the operation, dies, and dissection displays large secondary deposits; but had no operation been performed, the termination of the case and the morbid appearances would have been, in all likelihood, the same. Operations performed after well established rigors are almost constantly fatal, secondary inflammation having previously existed. I do not recollect of having seen one case of compound fracture or amputation recover after the supervention of severe rigors. The question of immediate or secondary union cannot be settled by statistical data, except the physical and dynamic causes which were in operation be thoroughly understood. Out of ninety-two cases, treated by Percy by immediate union, eighty-six were cured in twenty-six days; of seventy-five treated in the same method by Lucas, five died; of six operated on by Pelletan, and treated by union by granulation, one recovered.

Mr Phillips, in order to avoid both the danger of rapidly arresting an extensive drain, and the acknowledged disadvantages of secondary union, proposes to establish an issue in the vicinity of the stump, previous to amputation. Such a practice would be attended with

many obvious inconveniences; and if the Surgeon should consider it his duty to keep up a discharge, it might be easily managed by using thick ligatures, allowing both ends to remain, and applying irritating ointment to their projecting ends. Any ordinary discharge may be obtained by this means.

The most scientifically performed operation, and the most judicious and careful management of the case afterwards, cannot ensure a successful result after an amputation. The size, temperature, and ventilation of the apartment in which the treatment is conducted, influences the progress and final termination most materially. Considering the vast importance of this subject and its practical utility, it appears unaccountable that so little reference is made to it in the writings of practitioners in civil life. With the exception of Mr Alanson, whose *Practical Remarks* were published in 1782, I am not aware of any author who does more than allude to it. Military Surgeons seem to have been fully alive to its importance,—to have availed themselves of the advantages to be derived from attention to its details in practice, to the utmost extent, and in every work which they have bequeathed to posterity, it occupies a prominent place. The brilliant success which has attended the amputating knives of our Surgeons on the field, when compared with the results in civil life, [*See Appendix,*] is in no small degree, I think, attributable to the studious manner in which they guarded against the evils arising from atmospheric vitiation. While our attention has been principally directed to the various methods of performing the respective amputations, I fear we have been neglecting a subject of much greater importance to our patients.

My remarks on this branch of my subject may appear too diffuse for a paper of this description; but I must plead as my excuse the importance of the questions discussed, and the diversity of opinion which prevails among the profession regarding them. I have heard valuable suggestions for improving the salubrity of the hospital of this City, proposed by one well competent for the task, treated with ridicule, and the existence of the causes, which were considered to call for the changes, scouted as a fiction; I therefore consider it highly necessary to fortify, as far as possible, every statement advanced, by proof, or by the opinions of individuals the better half of whose lives has been devoted to the management and improvement of hospitals.

The reparation of all injuries is very much influenced by the state of the atmosphere in which the patient is placed. When circumstances are in this respect favourable, adhesion of incised surfaces takes place readily, and granulation progresses speedily and steadily; whereas, these processes are more or less tardy and uncertain, according to the extent of the unfavourable change which the air has undergone. The nature and the extent of the change which occurs in the atmosphere of hospitals, is frequently beyond our powers of analysis, (like the gaseous matter which generates cholera, yellow fever, or ague, which cannot be detected by chemical reagents,) but it invariably manifests its existence by exerting a most baneful influence on the condition of ulcers, wounds, compound fractures, and indeed of all surgical cases.

The progress of surgical cases is witnessed to greatest advantage in a healthy rural district. Injuries are there easily healed, and amputations almost constantly followed by a speedy cure; the febrile reaction which follows the operation is mild and unimportant, the greater portion of the wound unites by the first intention, and an entire cure is rapidly completed without the occurrence of any symptom of an unfavourable nature. Like consequences, I think, as a general rule, will follow the operation every where, provided the air be kept fresh and untainted, and the patients placed in circumstances as nearly as possible similar, to those enjoyed in well ventilated country localities. The demand for accommodation in many of our large hospitals, is so great that they are frequently overcrowded, and the consequences are extremely unfavourable. It is a well-established fact, that when too many living beings are congregated within a given space, the atmosphere soon becomes so deteriorated by respiration, and so contaminated by unwholesome effluvia, as to be converted into a hot-bed for the propagation of disease, instead of a proper place for the recovery of lost health. This has been repeatedly proved on a large scale, when the persons were all healthy; and the evil is very much increased when the overcrowding is caused by persons who labour under various forms of disease. Dr Jackson, after thirty years' experience in military life, during which period he devoted himself with zeal and ardour to the improvement of hospitals, says, in his *Constitution of the Medical Department of the British Army*:—

"Where men, particularly sick men, are crowded together in a narrow space, the air is contaminated; where air is contaminated, the progress in the recovery of health is slow; even if apparently restored, the permanence is not secure.

It is proved in innumerable instances, that sick men recover health sooner and better in sheds, in huts and barns, exposed occasionally to winds, and sometimes to rain, than in the most superb hospitals in Europe. *Pure air, in this respect, is alone superior to all forms of cure, and to all other remedies without such aid.* Where a number and variety of human beings are accumulated under the same roof, the air cannot long remain pure. It may not be positively impregnated with contagion, but it is not salutary; and the energies of life are but feebly expressed under such a condition."—*Page* 339.

The space requisite for the accommodation of persons suffering from disease is much greater than is generally imagined, and directors of hospitals who are only partially informed of the injurious consequences of too great numbers, and naturally unwilling to shut their doors against the proper objects of the charity, frequently become the innocent causes of much suffering and misery. I have also seen much injury done by the professional attendants sanctioning the erection of temporary beds in wards already too full; as long as such practice is continued, we may readily forgive the ill-directed philanthropy of non-professionals. Sir John Pringle, in his *Suggestions for the Improvement of Hospitals,* published in 1796, lays it down as a rule "to admit so few patients into each ward, that a person, unacquainted with the danger of bad air, might imagine that there was room to take in a double or triple number;" and Sir William Blizard, who published about the same period, very shrewdly remarks:—

"The number of patients admitted into a hospital does not indicate the number of lives preserved, the degree of misery lessened, the sum of benefit to the community. The proportion *cured* and *relieved* in a given period, is what expresses the happy consequences to society. Ceteris paribus,—that proportion will rise or fall considerably, according to the degree of purity of the air respired; and this will be, inversely, according to the number congregated in a given space."

In the wards of an hospital for the reception of surgical cases, where large ulcers, burns of every degree, sloughing or gangrenous sores, &c. &c. always abound, exhaling effluvia, more or less offensive, and destroying the salubrity of the apartment, not only is injury likely to be sustained by the constant respiration of the air; but I am materialist enough to believe, that its contact with fresh incised surfaces and healthy sores, is calculated to superinduce morbid action. The extent of the vitiation depends on the number and kind of patients, and the period the apartment has been similarly occupied. It is next to a physical impossibility to keep apartments healthy, whatever may be their dimensions, if regularly inhabited by

victims of disease; and when a constant succession of patients is kept up for years, the evil reaches a most alarming magnitude. Proper attention to cleanliness so far, no doubt, mitigates the danger; but it cannot be thereby altogether removed, as the deleterious exhalations are perpetually going on, vitiating the fresh air as it is introduced, and clinging to the furniture, dress, and even the person of the patient with great pertinacity.

The records of surgery afford much evidence which tends to support the opinion, that an hospital becomes more fatal to life the longer it is occupied for the reception of the sick and wounded, and the oftener it is refilled. Military hospitals, at the seat of war, are generally occupied for a brief period only,—they receive the wounded after one or more actions, and when these cases terminate there is no further use for them; and the comparatively small mortality which has followed amputations on the field of battle, is, I think, satisfactorily accounted for on this ground. I am aware that many limbs are removed on the battle field, which an attempt would be made to save in civil practice; but I am convinced that a success similar to that which followed the amputations performed at Newbourg, New Orleans, Aboukir, Camperdown, Algiers, the Peninsula, Thoulonse, or Navarino, could not be obtained in any of our large, old-established hospitals, by the best Surgeons of the present day, even although they had the power of selecting the most healthy subjects for the experiment, the impure air would frustrate the attempt by inducing secondary affections.

When military hospitals are overcrowded, too long occupied, or filled with a relay of fresh cases immediately after the removal of the old, results as fatal as in large civil hospitals, are the consequences.

In March, 1837, after an action, the surgical hospital at San Telmo afforded a striking example of this. "There were thus," says Mr Alcock, "1041 patients in the hospital of the Legion, calculated to accommodate with due regard to health, 800; the chief press of the extra numbers fell upon the surgical hospital of San Telmo." The following gives the melancholy result:—

"17 Primary Amputations,	2 recoveries.
4 Intermediary,	all died.
3 Secondary,	1 recovered.
24 cases.	3 recoveries." *

* *Lancet*, 1840-41.

Mr Guthrie gives the result of his extensive experience regarding the condition of hospitals overcrowded, or too long occupied, in the following terms:—

"After a great battle the wounded are usually collected in large hospitals. If the hospitals are not greatly thinned at the end of three or four weeks, no wounds do well, and the health of most of the men is affected by the air of the hospital, a fact that is constantly demonstrated by the amendment of those who are able to travel to a new station or establishment. Amputations performed in an hospital of this kind seldom do well; the febrile irritation remains after the operation, the wound suppurates, does not unite, the strength gradually decays, and the patient dies exhausted. The whole of this statement was exemplified in a very striking manner in our hospitals, after the battle of Vittoria, properly so called; and a second time after the battle of the Pyrenees, near Pampeluna, where the same hospitals were necessarily a second time filled with the wounded, many of whom required the greater operations of amputation."

Mr Guthrie's evidence alone is quite sufficient to prove the absolute necessity of "attention being paid to the cardinal object—AIR;"† but the following quotation from Dr Hennen's excellent *Treatise on Military Surgery*, puts the matter in a still clearer light:—

"But the grand source of safety to the individual is a removal to a distant and separate ward. * * * * * *
* * * * * * *
I have witnessed hundreds of cases in confirmation of this; I have seen the men, who, on the first day of a transfer from one hospital to another, have been obliged to be assisted into the boats or waggons, or held on mules, enjoy a sound night's repose, awake with a craving appetite, have a free, copious and natural alvine discharge, and proceed on rapidly towards a convalescence or cure, which has only been interrupted by their arrival at an hospital station. When I reflect, on the other hand, on the poor sallow dejected beings that have pined in the hospitals; the flabby, non-adhering, inanimate stumps, lined with a discoloured, half-digested sanies, which disappointed my most sanguine hopes,—I shudder at the contrast."—*Page* 272.

I think then it is abundantly proved, that an hospital, occupied only for a brief period, if overcrowded, or filled with a relay of fresh cases immediately after the old ones are removed, is thereby rendered unhealthy, excites a febrile action of a peculiar kind, and occasions a large mortality after all surgical operations; if so, what must be the consequences of confinement in an hospital, which has been for a long series of years inhabited by the victims of disease and poverty,—which is divided into too large apartments,—is often overcrowded,—and to thoroughly clean and whitewash which, an opportunity is seldom afforded? The Glasgow Royal Infirmary is such an hospital, and the mortality after amputations, and other surgical cases, is just

† Blizard, page 86.

such as we would be led, *a priori*, to anticipate, from what is known of the fatal effects of breathing an impure air. The progress of surgical cases in this hospital, is calculated to strike with astonishment the Surgeon who has witnessed practice chiefly in healthy situations. Wounds, which he would have considered too simple to demand his attention in the house of the poorest peasant, and under the most adverse circumstances, here not unfrequently set the attendants' every effort at defiance, aided, although he be, by the most powerful adjuvants, which the liberality of the Managers can place at his disposal. When the wards are overcrowded, or even filled with their usual complement, hospital disease, in some form, frequently does much havoc. I have seen four or five patients, in the same apartment, similarly affected, and several dismissed the house at the same time. The following cases are given, as illustrations of the occasional fatal tendency of the air of the wards; they are by no means singular or uncommon in this house, and they are not the whole I could adduce; but they are selected as unequivocal instances of death from hospital affections,—the diseases for which the patients were admitted being too trivial to impair the vital functions, or to occasion the fatal result:—

A woman, with a varicose aneurism on lower lip, had an incision about an inch in length made on one side to destroy its vascular connections,—phlebitis and death were the result.

A man had an injection thrown into the tunica vaginalis testis, for Hydrocele,—phlebitis followed, and terminated as usual, fatally.

A young man was admitted into the accident ward, in consequence of a slight bruise on dorsum of foot,—subfascial inflammation, phlebitis, secondary deposits, and death, supervened.

A man admitted with disease of lower maxillary bone, was suddenly seized with erysipelas, and died.—The disease was prevailing extensively in the ward at the time, and several had narrow escapes.

I purposely avoid giving any instances of death from hospital diseases, following the operation which is the subject of this paper, as it might be alleged, the fatal result was the consequence of the shock and local injury; but I may add a few circumstances which tend to prove that the state of the wards influences the result. During the period when a gentleman was Acting-Surgeon, who is universally granted to be an expeditious, excellent operator, and who

devotes much attention to the after treatment, the wards were constantly over-crowded, and the mortality after amputations was alarmingly great, perhaps as much so as at any other period in the history of the house.*

A short time ago, the wards happened to be unusually empty, and I saw two cases of amputation followed by union by the first intention, and an entire cure, with the formation of only a few drops of pus.

I have seen stumps which looked healthy during the week that no new patients were admitted into the ward,—assume diseased action when it became crowded during the following or receiving week.

Dissection shows the *causa mortis* in a large proportion of amputation cases, to have been those diseases which are almost peculiar to hospitals, such as, dysentery, erysipelas, phlebitis, subfascial inflammations, and secondary deposits.

The appearance of the stumps during the treatment in this house, frequently exhibit all those appearances so accurately described by Alanson, Blizard, Blane, Guthrie, Hennen, and Barons Larry and Percy, and attributed by those authorities to hospital causes.

I might adduce numerous instances of ulcers, which, without the benefit of treatment or cleanliness, have advanced slowly, during a series of years before admission, and after the patient has become subjected to the air of the wards for some weeks, have commenced to slough extensively, occasionally requiring the removal of the limb;—of wounds, all but cicatrized, which have been attacked by erysipelas, sloughing or hospital gangrene, which could only be checked by the patient's removal to a better atmosphere; but I think enough has been already said, to show that the hospital is frequently in an insalubrious state.

The propriety of performing such an operation as an amputation, in apartments where diseased actions are so apt to be superinduced, is very questionable, and can only be sanctioned, I think, by the urgency and necessity of the case;—for a portion of the patients who present themselves, it is manifestly a very improper place of refuge. A large class are out-door labourers, who are sometimes brought from a distance; they are generally in robust health,—have been accustomed to breathe air fresh and untainted,—they are suddenly introduced, in a

* The mortality was not accounted for by an extra number of primary operations.

a state of great susceptibility to disease, to the deteriorated atmosphere of a crowded ward,—every thing is strange—disease and death present themselves on every side,*—the natural buoyancy of their minds leaves them, and they fall under the influence of the depressing passions; another class are chronic cases, brought from the country after the constitutional powers are weakened and impaired by the combined influence of the disease and remedial agents; if an operation be performed under these circumstances, in a place where the most favourable cases narrowly escape, is it surprising the result should be fatal? I cannot help thinking that country surgeons are seriously to blame for sending such cases to an hospital; indeed, no conscientious person, cognizant of the real state of matters, would do so. The limb may be more scientifically removed, by a surgeon in the habit of using the knife; but this advantage will be much more than counterbalanced by the inferior air of the hospital. I am satisfied a patient has a better chance of a recovery, either after an accident or an operation, in the most inconvenient house in the poorest village, than in any large hospital; indeed, I cordially assent to the opinion of a Surgeon of considerable hospital experience, "that he would rather operate in the lowest hovel in Glasgow, than in its Royal Infirmary."

The Glasgow Royal Infirmary was established in 1794, when the population of town and suburbs was below 77,385, and the latest addition was made to the portion to which my remarks chiefly refer, in 1815, when the population was under 147,043.† At that period the house was sufficiently large for the amount of population, and was rarely overcrowded; but, in consequence of the unprecedented increase of the city and suburbs (now upwards of 282,134), as well as in districts from which patients are sent to the house, the accommodation for surgical cases is insufficient, and the wards are therefore generally too full. Each surgical ward is now destined for the reception of seventeen patients, but until lately, very often contained from nineteen to twenty-one. The present number is in my opinion, by far too great for surgical cases; it rarely indeed happens, that one

* "The scene of parting life should be veiled, as much as possible, from patients in the wards of an hospital."—*Blizard, page* 70.

† I am aware that at this period fever cases were treated in the front house, but they were then so rare, that the late Dr Cleghorn, in 1815, told the students he could not show them a case of Typhus.

or more bad cases, calculated to contaminate a whole ward, do not present themselves out of every seventeen. There is much evidence to prove that large wards are much more pernicious and fatal than small ones, and that there should rarely be more than four or five beds in one apartment, if even that number. An excellent paper, by M. Malgaigne, Chir. de l'hospice de Bicetre, in a recent medical periodical, affords a good corroboration of the correctness of these statements, from which I gladly avail myself of a quotation.

" Pourquoi les hôpitaux sont—ils plus meurtriers après les opérations que la pratique civile? On pense généralement que cela tient à la réunion des malades qui vicient l'air, tandis qu'en ville il n'ya qu'un seul opéré dans une seule chambre. Cela est vrai en partie; et je rapporterai tout à l'heure des faits qui montrent que les malades dispersés dans des salles plus petites guérissent mieux que dans des salles plus grandes." * * *

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Mais dejà nous pouvous commencer un singulier parallèle et qui semble tout fait pour eclairer la question. Au Ier Juillet, 1809.—l'administration avait ouvert une maison de santé pour les vénériens en état de payer; c'était dans une maison attenant à l'hospice des vénériens même; l'administration, le service de la pharmacie, étaient les mêmes; le chirurgien en chef des vénériens, Cullerier, etait également chirurgien de la maison de santé, L'unique différence consistait dans le nombre des lits et la disposition de la maison; il y avait 19 chambres contenant chacune deux ou trois lits, et 14 chambres à un seul lit; et le nombre des malades croissant d'annee en année, ne dépassa point jusqu'en 1814, le chiffre de 269. Or sur un total de 923 malades, il n'en mourut que 13, un sur 71; proportion d'autant plus remarquable que presque tous les malades étaient du sexe masculin, qui à hôpital voisin en perdait un 56e.

" Je n'ai pas eu depuis lors à ma disposition tous les comptes rendus des hôpitaux; mais ce qui suit suffira de reste pour achever la démonstration,

" 1814—Hôpital des Vénériens,.....3496 Malades——Morts, 1 sur 70
—— Maison de Santé,..... 344 —— —— 1 sur 142
1817—Hôpital des Vénériens,.....2362 —— —— 1 sur 60
—— Maison de Santé,..... 316 —— —— 1 sur 316
1818—Hôpital des Vénériens,.....3094 —— —— 1 sur 50
—— Maison de Santé,..... 356 —— —— 1 sur 178."

—*Archives Generales De Medicine, Mai* 1842, *page* 74.*

I have said this hospital does not admit of being properly ventilated. Fresh air can only be introduced by the doors and windows, and except the weather is unusually mild,—only in currents. The patients nearest the doors either cover themselves entirely with bed clothes, and raise the temperature by the respired air, or they take the first opportunity of closing up every crevice. The apartment is thus warmed, and the atmosphere rendered rarer; but by degrees it becomes unpleasant, or the smell attracts the attention of the nurse or other attendant, and a door or a window is opened, and the exter-

* I regret I had not an opportunity of perusing M. Malgaigne's paper before this Essay was sent to press, as it appears to me one of the most valuable contributions to the Statistics of Amputation hitherto published.

nal air rushes in at every opening,—a fruitful source of annoyance and indisposition to the inmates. Such a method of ventilation is ill suited for any purpose, but especially for hospitals, where the condition of the patients requires more than ordinary care. Nurses are sometimes blamed improperly for having the apartments at the hour of visit in a condition which does not please the Surgeon; although her only duty was to attend the doors and windows, she could not succeed in maintaining a proper temperature or current of air in this very changeable climate by the means at her command,—the opening or shutting of doors and windows;—the error lies in the improper method of ventilation employed.

That an opportunity for cleaning and whitewashing this hospital seldom occurs, is almost a corollary on the statements made regarding the crowded state of the wards; all the apartments being already sufficiently full, there is no way of disposing of the patients to have even one renovated at a time, except when there is an immunity from disease, and when this process is least requisite. The cleaning of the wards by scraping the whiting, and carefully washing all the surfaces with hot lime, is of much greater importance in improving the salubrity, than is generally granted. Howard, in his *Lazarettos in Europe,* gives a very good illustration of the advantages of the practice :—

"In addition to what has been said with regard to cleanliness, it may be observed, that when quicklime is slaked in boiling water, and immediately used, it not only destroys vermin, but is found to be one of the strongest antiseptics. In confirmation of this fact, I shall take the liberty of mentioning a remarkable instance of its efficacy in this respect. Dr John Hope, the first physician to the Royal Infirmary at Edinburgh, informed me in one of my visits there, that two or three years before a putrid fever had prevailed in that hospital, and that one large ward in particular was so deeply infected, as to prove fatal, for some time, to the patients that were lodged in it; but that lime-whiting the walls had eradicated the infection, after washing the wards repeatedly with vinegar had failed of this effect; and that this *salutary* practice had been continued ever since."—*Howard's Lazarettos in Europe* (1791), *page* 118.

Until the publication of Dr Lawrie's tables, [*See Appendix,*] the extent of the mortality in this Infirmary, after amputation, was only known to the Surgeons in attendance, and probably never brought under the notice of the Managers. In a letter addressed to them, by Dr A. D. Anderson, in 1821, the evil consequences resulting from the bad system of ventilation, the neglect of cleanliness of the patients' persons, &c., the want of exercise, and proper dieting, are very

clearly pointed out, but no reference is made to the mortality after operations or surgical cases. I fear that very temperate remonstrance has had little influence with the parties to whom it was directed; many of the evils there complained of, are still in existence, and others have been done away with, only within the last eight or ten months.

Dr Lawrie's labours have shown the profession, that the mortality in the house after amputations, from 1794 till the end of 1838, has averaged 36.3 per cent.; but he states that many of the journals were amissing, and others too ill kept to be serviceable. Many Surgeons, unwilling to believe the mortality so large, fancied that if all the records had been obtainable, the result would have been more satisfactory; but I believe 36.3 is much below the average mortality at the present period. By the kindness of the Surgical Officers I have been allowed to examine the Journals from 1st May, 1839, till 1st May, 1842, inclusive. The following table gives the result, which will be seen to be even more unfavourable than those given by Dr Lawrie.

Amputations performed in Glasgow Royal Infirmary, from 1st May, 1839 till 1st May, 1842.

	No. of Cases.	Cured.	Died.
FOR DISEASE.			
Fore-arm,	2	1	1
Thigh,	14	8	6
Leg,	6	5	1
Total,	22	14	8
PRIMARY, FOR INJURY.			
Shoulder Joint,	1	—	1
Wrist,	1	1	—
Fore-arm,	1	1	—
Arm,	2	1	1
Thigh,	8	1	7
Leg,	10	6	4
Total,	23	10	13
SECONDARY, FOR INJURY.			
Shoulder Joint,	1	—	1
Arm,	5	2	3
Thigh,	3	—	3
Leg,	4	3	1
Total,	13	5	8
Grand Total,	58	29	29

It may be not altogether uninteresting to compare this table with one giving the amputations performed in the University College

Hospital, London, furnished by Mr Potter. The hospital was established about five years ago, and the cases are given from the commencement:—

Result of Amputations performed in University College Hospital, London.

	No. of Cases.	Cured.	Died.
FOR INJURY, PRIMARY.			
Arm,....	1	1	—
Fore-arm,....	2	2	—
Wrist,....	1	1	—
Thigh,....	2	1	1
Leg,....	3	2	1
Both Legs,....	1	—	1
Total,	10	7	3
FOR DISEASE, AND SECONDARY.			
Shoulder Joint,....	1	1	—
Arm,....	7	5	2
Fore-arm,....	6	6	—
Thigh,....	20	17	3
Leg,....	22	20	2
Total,	56	49	7

The difference in results shown by these tables is very great, and cannot be purely accidental. I do not think that it can be accounted for by any difference in the mode of operating or after management; but am inclined to attribute the greater success in the latter instance to the short period the hospital had been occupied, and consequently the comparatively pure atmosphere and absence of all animal contagion.

I have often been told when expressing my surprise at the unfavourable symptoms and large mortality after amputations, in this Infirmary, that matters are as unfortunate elsewhere; but granting, for argument's sake, that the statement is correct (and it is not, for with the exception of the Parisian hospitals, no other gives 50 per cent.—see Appendix), it does not follow that a remedy cannot be discovered for the evil.* As well might we argue that nothing is to be done to relieve the distress which prevails in one district of the country, because things happen to be as bad elsewhere. The grand question comes to be, is amputation, *qua* amputation, necessarily followed by a mortality of 50, 36.3, or even 23 7-10ths per cent.?

* Since the above was sent to press, the Directors of the Edinburgh Infirmary have commenced extensive and expensive alterations, with the view of improving the salubrity of their surgical wards, which had lately proved very destructive to life.

From all the facts that have fallen within my knowledge, I do not think that it is an operation attended with a large mortality when the external circumstances are favourable. During a residence of upwards of seven years in a rural district, I heard of only one fatal case, (and in that instance the patient died on the table, or immediately afterwards,) although I carefully ascertained the termination of every case, which occurred within a circuit of some miles. I have invariably found, on conversing with members of the profession, of extensive experience in country practice, that it was not considered a fatal operation. I am aware of the fallacious nature of statistics from memory, but if a mortality similar to that which occurs in the hospital had been met with, it could not easily have been forgotten; indeed, if a country surgeon were to lose every second or third case, such a fama would be raised against his reputation as an operator, that he would soon have few opportunities of using the knife.

Phlebitis and secondary inflammations, which are, as has been already stated, so destructive to life after amputations and surgical cases in hospitals, are seldom met with in well-ventilated habitations. I never witnessed a death from these causes, except in hospitals, nor has such an occurrence come to my knowledge; and it may be remarked that a junior surgeon in a country district has a much better field for witnessing surgical cases, than his compeers in large cities, where the class of patients, most liable to injuries, and most likely to fall to the charge of a young man, are almost universally sent to an hospital.

When circumstances were favourable,—hospitals unpolluted, and numbers small, amputations have been very successful, even in hospital practice, and I think that under similar conditions like results would follow now. Mr Alanson says,

"I have never refused to operate on any case that has presented, where a single person in consultation has thought such an operation advisable; and since I began the method here recommended in Case I., I have operated in thirty-five cases, without the loss of a single case."—*Page* 15.

I do not believe that any hospital Surgeon of the present day could make such a statement; and it is a remarkable coincidence that the mortality in this hospital, at an early period, was nearly as low:—

"It struck me as remarkable, that the first thirty amputations, in the list 'for disease,' viz., from the year 1794 to 1810 inclusive, twenty-nine recovered, and one died."—*Lawrie on the Result of Amputations, page* 5.

From these and various other considerations, I am led to conclude that the fatality after amputations is rendered unnecessarily great, in consequence of operating in apartments where the atmosphere is more or less vitiated, and that it admits of being greatly diminished by availing ourselves of the discoveries in chemistry, pneumatics, and mechanics.

The subject has lately been brought prominently before the Managers by a professional member of the Board, whose attention was directed to it while an Acting-Surgeon, and who has since devoted much consideration to its details; and a ward has been exclusively set apart for patients who have undergone a serious operation. This is possibly the cheapest remedy that could have been devised, but I fear, although it may somewhat improve upon the present condition of things, that it will, for the following reasons, prove inefficient:—

1st, The apartment does not admit of being properly ventilated.

2d, One or two unfavourable cases are calculated to contaminate and spread contagion through the whole ward.

3d, The arrangement does not provide for compound fractures, which require as much attention as operation cases.

The suggestions which I am about to make, I humbly submit, are calculated if carried into effect, to afford patients labouring under serious injuries, compound fractures, and after operations, all the advantages that can be enjoyed in private houses, under the most favourable circumstances. A considerable outlay of money would be requisite, but I do not consider that an insurmountable objection. The public charities of a city are calculated to reflect more credit on the character of its inhabitants than its palaces.

If the population of this city, suburbs, and parishes, which sends patients to this Infirmary, continues to increase in the same ratio as of late years, some increased accommodation for surgical cases will be absolutely necessary. In my own opinion, it is already demanded; and by carrying improvements into operation immediately, the patients would be spared much suffering and misery, and the Surgeons much anxiety and disappointment "in completing a good cure, or seeing the patients languish under a hectic, *incurable in a crowded infirmary.**

This paper has already so far exceeded the limits to which I intended to confine myself, that I must merely give the outlines of my plan, but the details can be very easily followed out.

* Alanson, page 99.

The present Infirmary being too limited in dimensions for accommodating, with due regard to health, the surgical cases which present themselves, being deficient of airing or exercising accommodation, and without any apartment where the bedding and bed clothes can be purified, I recommend to the consideration of the Managers the propriety of erecting a building, three stories in height. The first or basement flat to be divided into two apartments.

The first to be fitted up exactly on the plan of drying houses in manfacturing establishments, calculated to admit a constant free current of air, but no moisture. To this apartment all the bedding of patients able to take exercise are to be carried by themselves every morning before eleven o'clock, and there to remain a certain period; likewise all the body clothes of patients while not in use. In the Infirmary at the present time the bedding is too seldom exposed in the open air; indeed, except in dry weather, there is no opportunity of doing so. The propriety of airing regularly the bedding of patients appears too obvious to require proof. If such were necessary, the unparalleled success which attended the efforts of Captain Cooke, in his voyages round the world, is sufficient:—

"To preserve the health of his crew, he took particular care to keep their persons, hammocks, bedding, clothes, &c., constantly clean. He was not satisfied with ordering upon deck the hammocks and bedding every day that was fair, but took care that each bundle should be unlashed and so spread out, that every part of it might be exposed to the air."—*Cook's Voyages, page* 114.

The second to be fitted up as a dining room, or refectory, in which all patients who are able to leave bed may receive their meals,—the males before or after the females.

The system of supplying all patients with their food in bed, which is now followed, I consider highly reprehensible, calculated to uproot every innate feeling of cleanliness—to soil bed clothes, and collect filth in bed. How any patient can eat, without loathing, in the vicinity of sloughing sores, which are diffusing their stench over the whole ward, is to me a problem. Could the Managers, amid the multiplicity of their avocations, condescend to investigate matters of minor interest, this evil would soon be remedied.

The second floor I would also divide into two apartments, the first to be set apart as an exercise and work room for the males, the other for the females.

In the hospital at the present period there is no place for exercise

exeept in the open air, and in this elimate advantage can be seldom taken of it during the most unhealthy season of the year. There is no convaleseent house for either the medieal or surgical cases.

The propriety of affording all patients, not confined to bed, regular exercise of mind and body, is, I think, sufficiently obvious,—it would invigorate the whole system, and banish *ennui*, which is so apt to take possession of people constantly confined to one apartment; during the absenee of the patients to the exercise room, the nurse, with her assistants, would have sufficient time to clean every part of the ward, beds, &e.,—and the air would be rendered purer from having fewer patients to supply with oxygen, and those who remained seriously unwell, would be spared the disturbanee which those with slighter ailments are so apt, thoughtlessly, to create.

The third story I would propose to divide into distinet, spacious, high-roofed apartments. Eaeh apartment to be fitted up with an iron bedstead and small painted table, to have no cornice or other ornament, so apt to secrete animal contagion, and to have as little wood fittings as possible, and all well painted. Into each apartment *one patient only* is to be placed, the nature of whose injuries eall for great care and attention,—such as serious bruises, eompound fractures, and all operation eases. When one ease has terminated, the bedstead, bedding, and table are to be removed, the plaster and wood work eare-fully washed, the windows thrown open, and the apartment kept empty for two or three weeks according to the option of the Surgeon, and the demand for aeeommodation. Were sueh a plan followed, patients would have nearly all the advantages of those in country situations, and I doubt not, the same happy exemption from mortality would be the gratifying result; aud the Managers would be enabled to make a more satisfactory return than has issued from this, or any other large hospital, for many years. Indeed, the propriety of small wards does not appear to me to be a matter of doubt; the question is set at rest by many reeent instanees. The following is given as one of the most conelusive :—

" Mais nous avons des faits comparables bien plus prècis à allèguer en faveur des petites salles; ils nous sont fournis par cette époque de douloureuse mémoire, où l'invasion de la France et de Paris encombra de blesses nos hopitaux, et oblige d'en etablir partout où l'on pût de provisoires.

" On n'avait encore à loger que des blessés français, lorsque le prefet de la Seine, pressé par le Conseil des hopitaux, mit à sa disposition les abattoirs du Roule, de Montmartre, et de Ménilmontant. On sait que ces abattoirs se

composent de pavillons isolés, séparés par de larges rues, avec un seul étage ; on se hâta de les mettre en état de recevoir des blessés ; et ils servirent successivement d' asyle aux blessés français et aux blessés ennemis. Nous avons la statistique de la mortalité des uns et des autres, soit dans ces abattoirs, soit dans les autres hôpitaux de Paris ; circonstance précieuse, parcequ'elle nous fournit les élèments de comparaison ces plus semblables qu'on puisse desirer.

" Or la mortalité des blessés frsnçáis fut :—

" A l'Hôtel-Dieu,.....de 1 sur 5
A la Pitié,.....de 1 sur 5
A Saint-Louis,.....de 1 sur 8
Aux Vénériens,.....de 1 sur 9

" Et dans les trois abattoirs signalés, la mortalité fut réglée comme il suit :—

" Au Roule,.....de 1 sur 10
A Montmartre,.....de 1 sur 12
A Menilmontant,.....de 1 sur 13

" Je néglige à dessein les fractions Maintenant pour les Soldats ennemis, dans les grands hôpitaux la mortalitié fut :—

" A l'Hôtel-Dieu,.....de 1 sur 13
A la Pitié,.....de 1 sur 7
A Saint-Louis,.....de 1 sur 7

" On n'en mit point aux Veneriens. Et dans les abattoirs, la proportion fut :—

" A Menilmontant,.....de 1 sur 10
Au Roule,.....de 1 sur 11
A Montmartre,.....de 1 sur 19."

—*Archives Generales De Medicine, Mai, page* 78.

I have already characterised the system of ventilation followed in the present infirmary as faulty and insufficient, and in its stead I recommend for the building proposed, the method adopted in the Reform Club House, London. I cannot do better than give an account of it in the words of Dr Ure, to whose writings I am indebted for my knowledge of its details.

" It consists of a large fan, revolving rapidly in a cylindrical case, and is capable of throwing eleven thousand cubic feet of air per minute, into a spacious subterranean tunnel under the basement story. The fan is driven by an elegant steam engine, working on the expansion principle, of five horses' power. It is placed in a vault, under the flag pavement, in front of the building ; and as it moves very smoothly, and burns merely cinders from the house fires, along with some anthracite, it occasions no nuisance of any kind. The steam of condensation of the engine supplies three cast iron chests with the requisite heat for the whole of the building. Each of these chests is a cube of three feet externally, and is distributed internally into seven parallel cast iron cases, (somewhat like empty portfolios), each about three inches wide, which are separated by parallel alternate spaces, of the same width, for the passage of the air transversely, as it is impelled by the fan. This arrangement is most judicious, economizing fuel to the utmost degree ; because the steam of condensation which, in a Watt's engine, would be absorbed and carried off by the air pump, is here turned to good account, in warming the air of ventilation during the winter months. Two hundred weight of fuel suffices for working this steam engine for twelve hours. It pumps water for household purposes, raises the coals to the several apartments on the upper floors, and drives the fan ventilator. The air, in flowing rapidly through the series of cells placed alternately between the steam cases, cannot be scorched, as it is infallibly with air stoves ; but it is heated only to the genial temperature of from 75° to 80° Fahr., and it thence

enters a common chamber of brick work in the basement story, from which it is let off into a series of distinct flues, governed by dialled valves or registers, whereby it is conducted in regulated quantities to the several apartments of the building. I am of opinion, that it would not be easy to devise a better plan for the purpose of warming and ventilating a large house.

"It may be modified at little expense, so as to become the ready means of introducing, during the sultriest dog-days, refreshing currents of air at a temperature of 10, 20, 30, or even 40 degrees under that of the atmosphere. An apparatus of this nature, attached to the Houses of Parliament and Courts of Law, would prove an inestimable blessing to our legislators, lawyers, judges, and juries. Of such cool air a very gentle stream would suffice to make the most crowded apartments comfortable, without endangering the health of the inmates with gusts of wind through the doors, windows, and floors." *

Dr Ure states that this very elegant and efficient mode of ventilating and regulating the temperature of large apartments, is eventually cheaper than by stoves or any other means yet devised.

* The Civil Engineer and Architect's Journal, for April, 1812.

TABLE I.

Result of Amputations performed in Edinburgh Royal Infirmary, from 1st July, 1839, till 1st July, 1841.—Reported by Dr Reid.

	TOTAL.				MALES.			FEMALES.			PRIMARY.				SECONDARY AND OTHERS.			
	Males and Females	Cured.	Died.	No. of Days in Hospital	Total.	Cured.	Died.	Total.	Cured.	Died.	Total.	Cured.	Died.	No. of Days in Hospital	Total.	Cured.	Died.	No. of Days in Hospital
Thigh,.....	25	14	11	53	17	9	8	8	5	3	7	—	7	6½	18	14	4	72
Leg,.....	12	8	4	59	8	4	4	4	4	—	2	—	2	10½	10	8	2	67
Foot, different parts,	8	8	—	106	6	6	—	2	2	—	—	—	—	—	—	—	—	—
Shoulder Joint,	3	1	2	55	2	1	1	1	—	1	1	1	—	48	2	—	2	58
Arm,.....	1	1	—	40	1	1	—	—	—	—	—	—	—	—	1	1	—	40
Fore-Arm,...	2	1	1	27	1	—	1	1	1	—	—	—	—	—	2	1	1	27
Hand, different parts,	18	17	1	31	15	14	1	3	3	—	—	—	—	—	0	—	—	—
Total,.....	69	50	19	52	50	35	15	19	15	4	10	1	9		33	24	9	

TABLE II.

In Glasgow Royal Infirmary, from the commencement of the Charity in 1795, till the end of 1839, (many of the Records amissing,) reported by James Adair Lawrie, Esq. M.D., Senior Surgeon, Glasgow Royal Infirmary, &c. &c.

		No. of Cases.	Cured.	Died.	Deaths to Recoveries.
For Disease.	Shoulder Joint,	2	1	1	1 to 1
	Arm,	17	14	3	1½ to 7
	Fore-arm,	4	4	—	
	Thigh,	92	73	19	1 to 3 4-5ths nearly.
	Leg,	35	23	12	1 to 2 fully.
	Foot, (partial,)	3	3	—	
	Total,	153	118	35	
Primary,	Shoulder Joint,	3	1	2	2 to 1
	Arm,	23	12	11	11 to 12
	Fore-arm,	15	15	—	
	Hip,	1	1	—	
	Thigh,	12	1	11	
	Leg,	22	7	15	2 to 1 fully.
	Foot, (partial,)	2	2	—	
	Total,	77	38	39	
Secondary.	Shoulder Joint,	1	1	—	
	Arm,	13	6	7	7 to 6
	Fore-arm,	3	3	—	
	Thigh,	21	8	16	2 to 1
	Leg,	5	2	3	3 to 2 fully.
	Total,	46	20	26	
	Grand Total,	276	176	100	

TABLE III.

Results of Amputations in Military Practice.

By whom Reported, &c. &c.	Primary.	Died.	Mortality.	Secondary.	Died.	Average Mortality.
Baron Percy, at Newbourgh,	92	6	15.3			
Baron Larrey,	14	2	7.			
New Orleans,	45	7	6.4	7	5	1.2
Naval Action of 1st June, 1794,	60	8	7.5			
After Battle of Aboukir,	11	0		3	3	1.
Battle of Camperdown, Dr Wright—						
Upper Extremity,	7					
Lower Do.,	8					
Bombardment of Algiers—						
Upper Extremity,	28	7	4.	2	2	4.
Lower Do.,	29	15	1.9			
British Peninsular Army, in 6 months—						
Upper Extremity,	163	5	32.6	296	116	2.5
Lower Do.,	128	19	6.7	225	149	1.7
Thoulouse, Mr Guthrie's Report—						
Upper Extremity,	7	1	7.	16	4	4.
Lower Do.,	41	9	4.5	37	18	2.
Navirino, M. de Signore,	31	1	31.	38	13	2.8
Sir Love Hammick, (not stated whether Primary or Secondary,)	87	16	17.			

TABLE IV.

Result of Amputations performed in the Parisian Hospitals, from 1st January, 1836, till 1st January, 1841. Reported by M. Malgaigne, Chirurgien de l'Hospice de Bicetre, (Archives Generales de Medicine pour Mai, 1842.)

		No. of Cases	Cured.	Died.
Hip Joint,.....	For Disease,	—	—	—
	Injury,	1	—	1
Leg,.....	Disease,	153	61	92
	Injury,	46	12	34
Shoulder Joint,	Disease,	6	3	3
	Injury,	8	—	8
Arm,.....	Disease,	61	37	24
	Injury,	30	13	17
Fore-arm,.....	Disease,	17	12	5
	Injury,	11	8	3
Wrist,.....	Disease,	12	12	—
	Injury,	11	4	—

TABLE V.

Amputations performed at the Massachusetts General Hospital,—reported by Dr Hayward,—(since opening of Institution.)

	PRIMARY.			SECONDARY OR OTHERWISE.		
	No. of Cases.	Cured.	Died.	No. of Cases.	Cured.	Died.
Thigh,.....	6	3	3	28	23	5
Leg,.....	5	3	2	19	15	4
Shoulder,.....						
Arm,.....	—	—	—	4	4	—
Fore-arm,.....	2	2	—	4	3	1
	13	8	5	55	45	10

Grand Total, 68 Cases, 53 recoveries, 15 deaths.

Amputations performed at the Pennsylvania Hospital,—reported by Dr Norrie.

	PRIMARY.			SECONDARY OR OTHERWISE.		
	No. of Cases.	Cured.	Died.	No. of Cases.	Cured.	ed.
Thigh,.....	—	—	—	4	4	—
Leg,.....	7	7	0	3	3	0
Arm,.....	2	2	—	4	4	—
Fore-arm,.....	1	1	—	2	2	—
Foot, (partial,) *	1	—	1			
	11	10	1	13	13	

Grand Total, 24 Cases, 23 Recovered, 1 Death.

* Operations performed in the above hospital, from its commencement till 1840, (the 24 included),—35 Primary, 24 cures, 11 deaths,—20 Secondary, 13 cures, 7 deaths—25 for Chronic Affections, 20 cures, 4 deaths. Of these 32 were of Upper Extremity, of which 27 were cured, and 5 died. 47 of the Lower Extremity, of which 31 were cured, and 16 died.†

† American Journal of the Medical Sciences, May 1840.

TABLE VI.

From various sources.

	No. of Cases.	Died.	Per Centage
Dupuytren,			
"Avec réunion mediate," ..	30	6	
"Avec réunion immediate,"	29	9	
Feroc,.....			1 in 30
B. Bell,.....			1 in 20
M. Bandens, at Mascara, Tlemsen, and Medeah,.....	23	1	
Collected by Mr Phillips. France,.....	203	47	
Germany,.....	109	26	
America,.....	95	24	
Great Britain,.....	233	53	
Total,	640	150	23 7-10ths

Baron Larrey states as the result of his experience, after 20 years' war, that he had saved three-fourths of his Amputations.

TABLE VII.

Amputations performed after the attack on the American lines, in front of New Orleans, in 1815. *Reported by Mr Wasdell, Surgeon to the Forces.*

	No. of Cases	Died.	Cured.
PRIMARY.			
Thigh,.....	7	4	3
Shoulder Joint,.....	3	—	3
Leg,.....	26	3	23
Arm,.....	9	—	9
Total,	45	7	38
SECONDARY.			
Thigh,.....	4	2	2
Leg,.....	2	2	—
Arm,.....	1	1	—
Total.	7	5	2
Grand Total,	52	12	40